

# **K-20 Educational Telecommunications Network**

The diagram illustrates the relationship between the K-20 Educational Telecommunications Network and the K-12 Sector. A large green rectangle at the top left represents the K-20 network. A smaller green triangle, representing the K-12 sector, is positioned to the right. Two lines originate from the bottom-left corner of the K-20 rectangle and extend towards the bottom-right corner of the K-12 triangle. A third line originates from the top-right corner of the K-20 rectangle and extends towards the top-right corner of the K-12 triangle. These lines suggest that the K-12 sector is a subset or a specific focus within the broader K-20 network.

**K-12  
Sector**

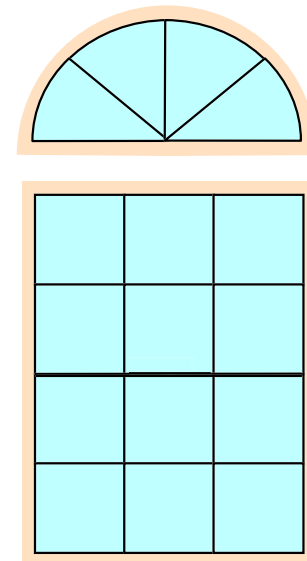
prepared  
by the K-20 Technical Working Group

# Outline of Presentation

1. Overview
2. Services
3. Scope
4. Technical Direction
5. Phase I -
  - Intranet/Data
  - Video
  - Satellite
  - Schedule
6. Phase II -
  - Intranet/Data
  - Video
  - Satellite
  - Schedule
7. Data Collection
8. Benefits of K-20 Network
9. Issues and Concerns
  - Equipment
  - Bandwidth/Transport
  - Caching Servers
  - Funding
  - Video
  - Other Issues
10. Questions and Discussion

# Overview

- Bill - E2SSB 6705
- \$43.7 million budget
- Involves 3 Phases



# Services

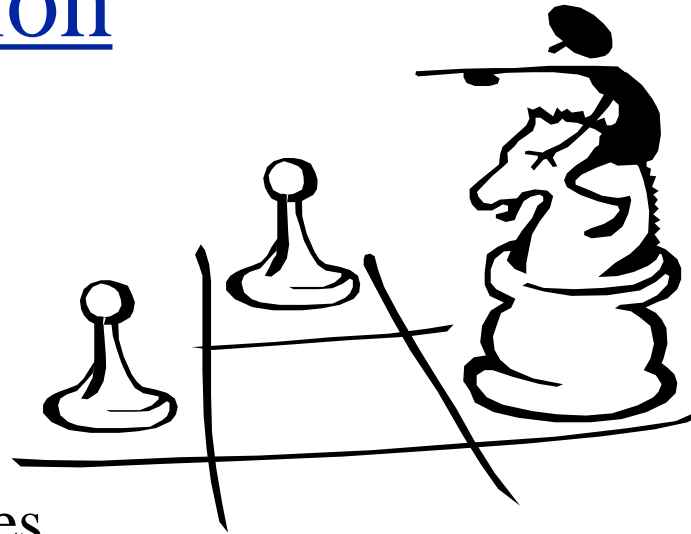
- Intranet/Data network
- Circuit Switched Video
- Satellite

# Scope

- Universities & 4-year Colleges
- Community & Technical Colleges
- Educational Service Districts
- School Districts
- Libraries
- Independents



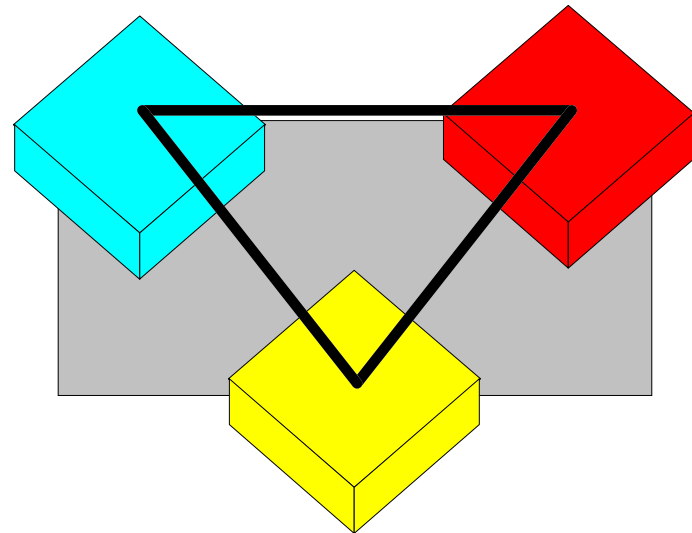
# Technical Direction

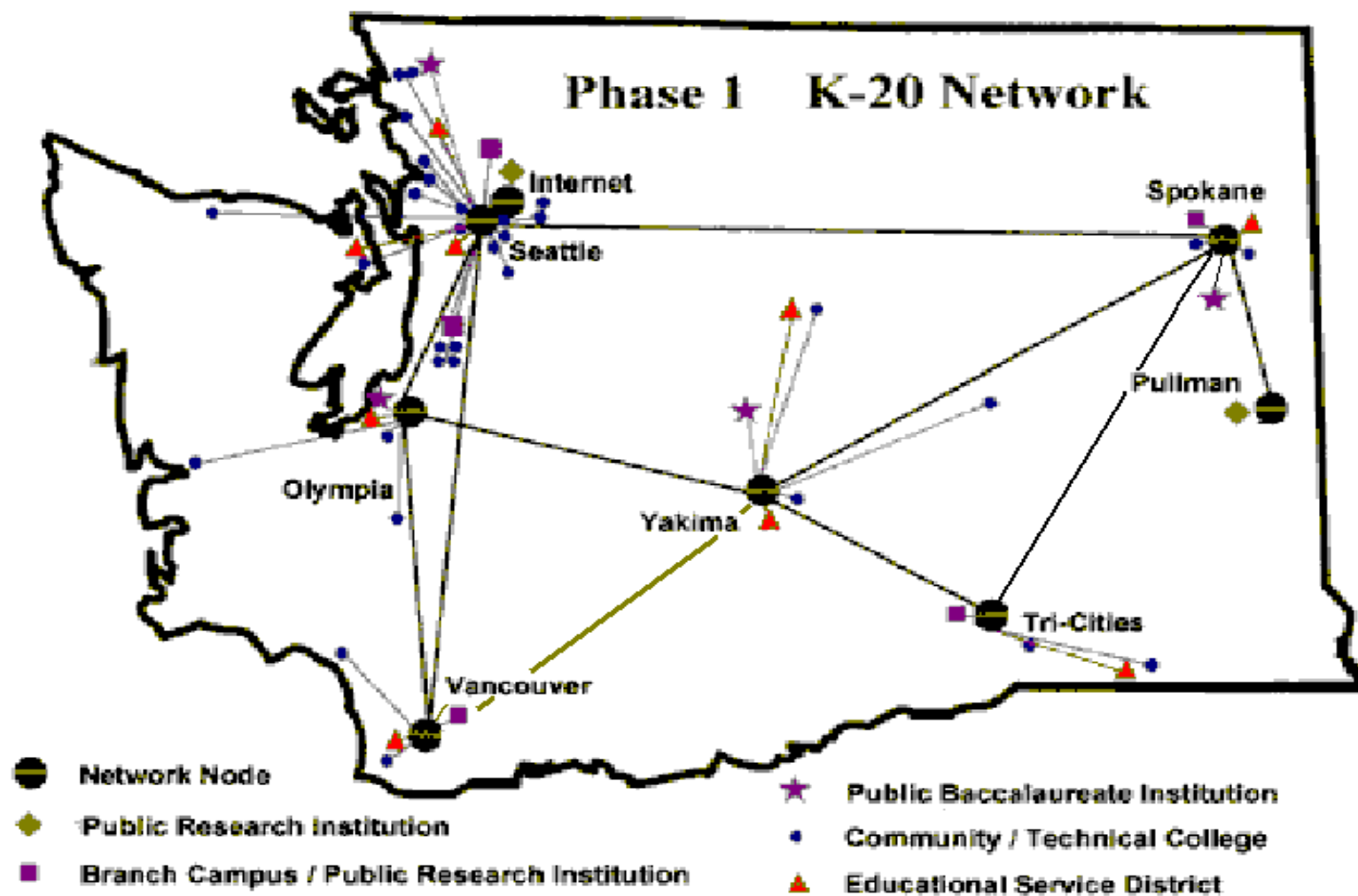


- Leverage existing facilities
- Use standard and interoperable technologies
- Make network scaleable

## Phase I - Intranet/Data

- K-12 hub routers
- 2 DS1s to ESDs
- Inverse Multiplexed (IMUX) technology
- Caching servers

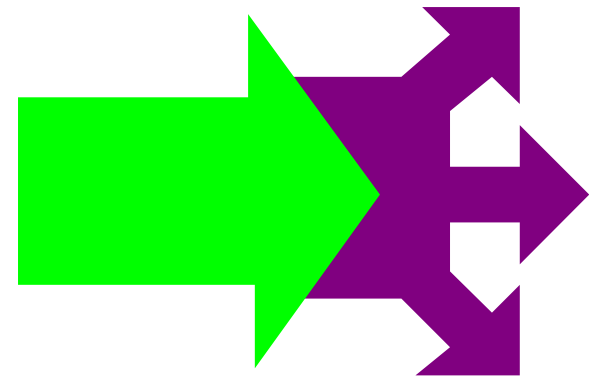


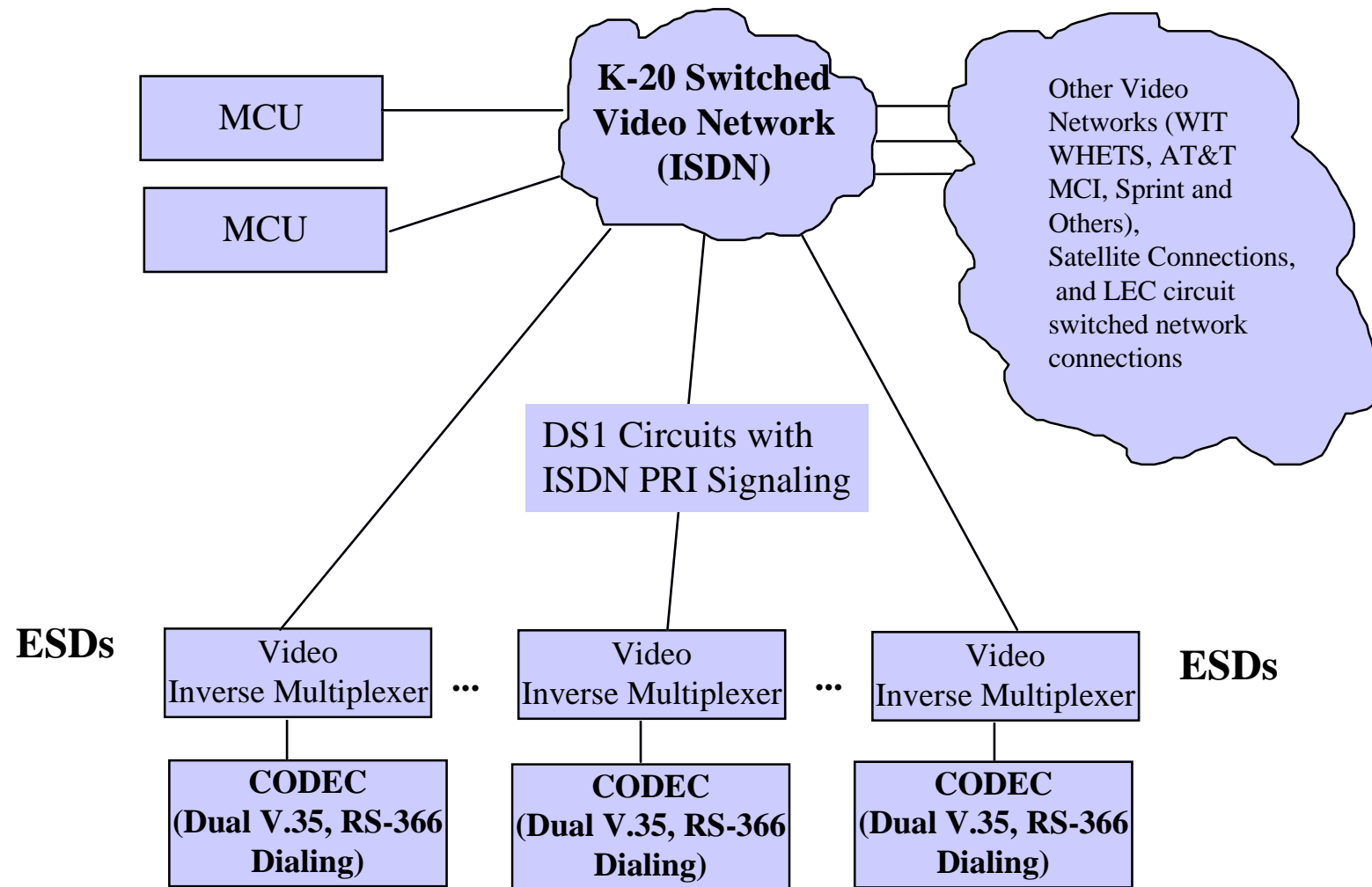




# Phase I - Circuit Switched Video

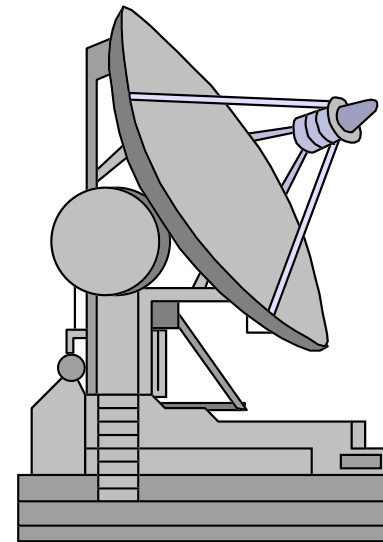
- PBX/switch (Lucent G3R)
- DS1 and video IMUX to ESDs
- CODEC at ESDs





# Phase I - Satellite

- Uplink services
- Video Master Control
- C and Ku - band



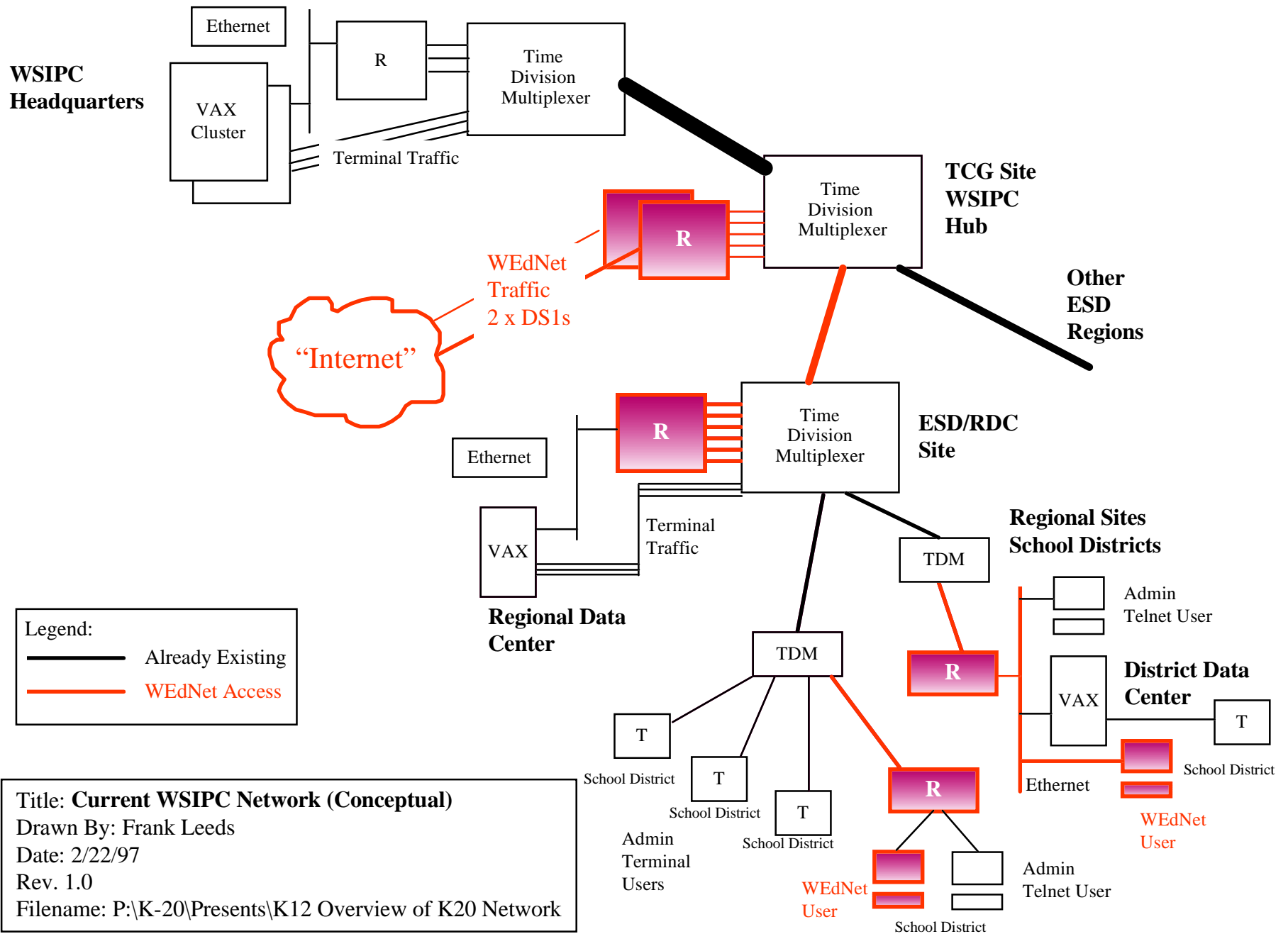
# Schedule Phase I

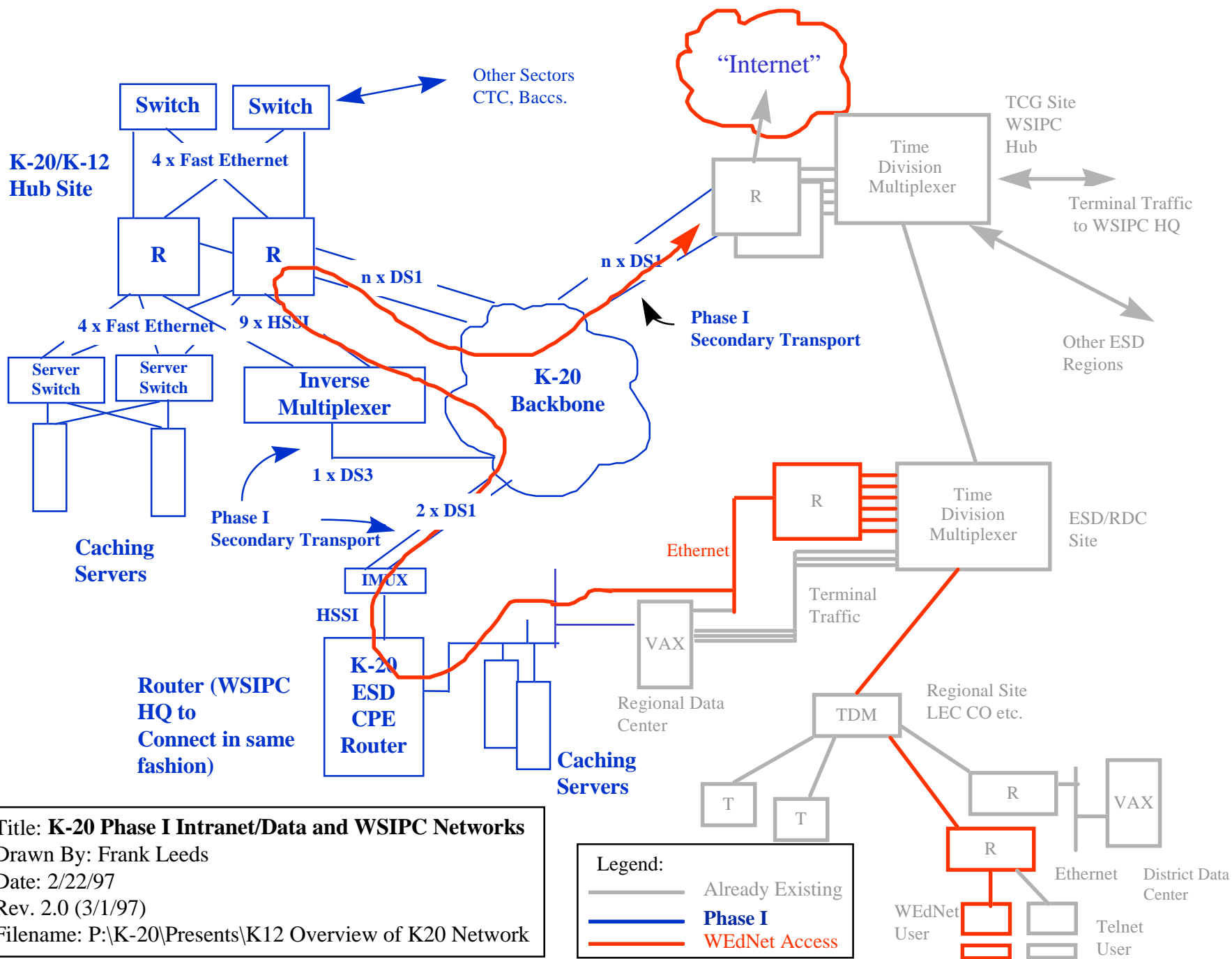
ID	Task Name	Start	Finish	ter	1st Quarter			2nd Quarter			3rd Quarter			4th Quarter			1st Quarter			2n	
					Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1	K12 Phase I	Wed 1/22/97	Fri 8/15/97																		
2	Work with WSIPC on Transition Plan	Fri 3/21/97	Thu 5/29/97																		
11	K20 PBX Installed & Circuits Connected	Wed 1/22/97	Tue 3/18/97																		
12	Upgrade Internet Connection to K12	Thu 4/17/97	Fri 8/1/97																		
13	Facilities Check at ESDs	Tue 4/8/97	Fri 5/16/97																		
18	Secondary Transport	Mon 3/3/97	Fri 8/1/97																		
23	Order and Staging	Mon 2/17/97	Fri 6/13/97																		
50	Ship Equipment	Mon 6/2/97	Tue 7/1/97																		
51	Contact Shipping	Mon 6/2/97	Tue 7/1/97																		
52	Create Label	Mon 6/2/97	Tue 7/1/97																		
53	Box Equipment	Mon 6/2/97	Tue 7/1/97																		
54	Label Equipment	Mon 6/2/97	Tue 7/1/97																		
55	Ship to ESDs	Mon 6/2/97	Tue 7/1/97																		
56	Install Hub Equipment	Mon 6/2/97	Tue 7/1/97																		
57	Test Hub Equipment	Mon 6/2/97	Tue 7/1/97																		
58	Certify Hub	Tue 7/1/97	Tue 7/1/97																		
59	Develop Test & Certification Plan for Data Equipment	Tue 4/8/97	Thu 5/29/97																		
60	Develop Test & Certification Plan for Video Equipment	Tue 4/8/97	Thu 5/29/97																		
61	ESD 101	Tue 7/1/97	Fri 8/15/97																		
84	ESD 105	Tue 7/1/97	Fri 8/15/97																		
107	ESD 112	Tue 7/1/97	Fri 8/15/97																		
130	ESD 113	Tue 7/1/97	Fri 8/15/97																		
153	ESD 114	Tue 7/1/97	Fri 8/15/97																		
176	ESD 121	Tue 7/1/97	Fri 8/15/97																		
199	ESD 123	Tue 7/1/97	Fri 8/15/97																		
222	ESD 171	Tue 7/1/97	Fri 8/15/97																		

prepared  
by the K-20 Technical Working Group

## Phase II - Intranet/Data

- Transport to school districts
- Routers
- Caching servers
- Network management at ESDs





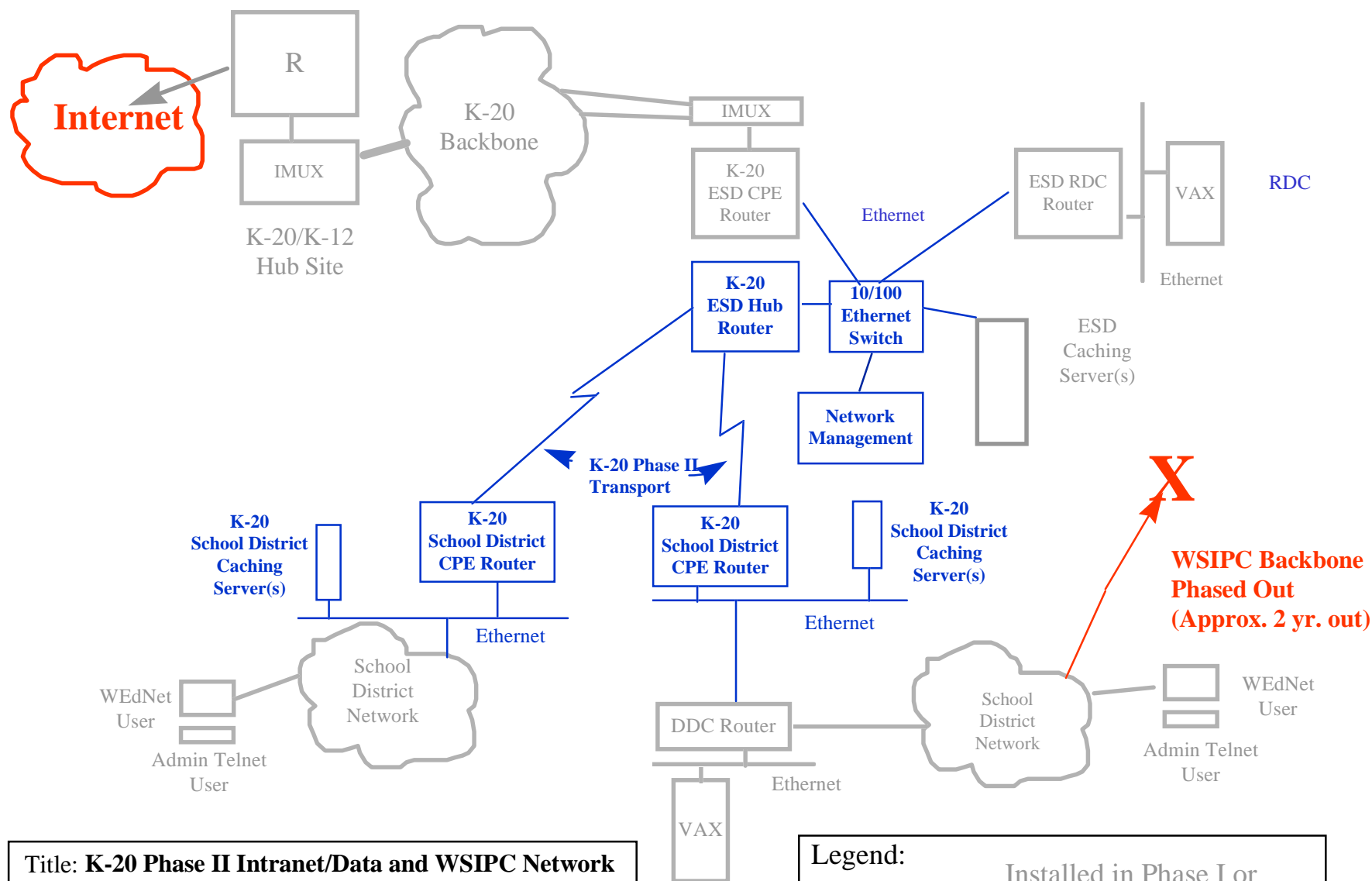
Title: **K-20 Phase I Intranet/Data and WSIPC Networks**

Drawn By: Frank Leeds

Date: 2/22/97

Rev. 2.0 (3/1/97)

Filename: P:\K-20\Presents\K12 Overview of K20 Network



Title: **K-20 Phase II Intranet/Data and WSIPC Network**

Drawn By: Frank Leeds

Date: 2/22/97

Rev. 3.0 (5/5/97)

Filename: P:\K-20\Presents\K12 Overview of K20 Network

Legend:

— Installed in Phase I or  
Already Existing

— Phase II Install



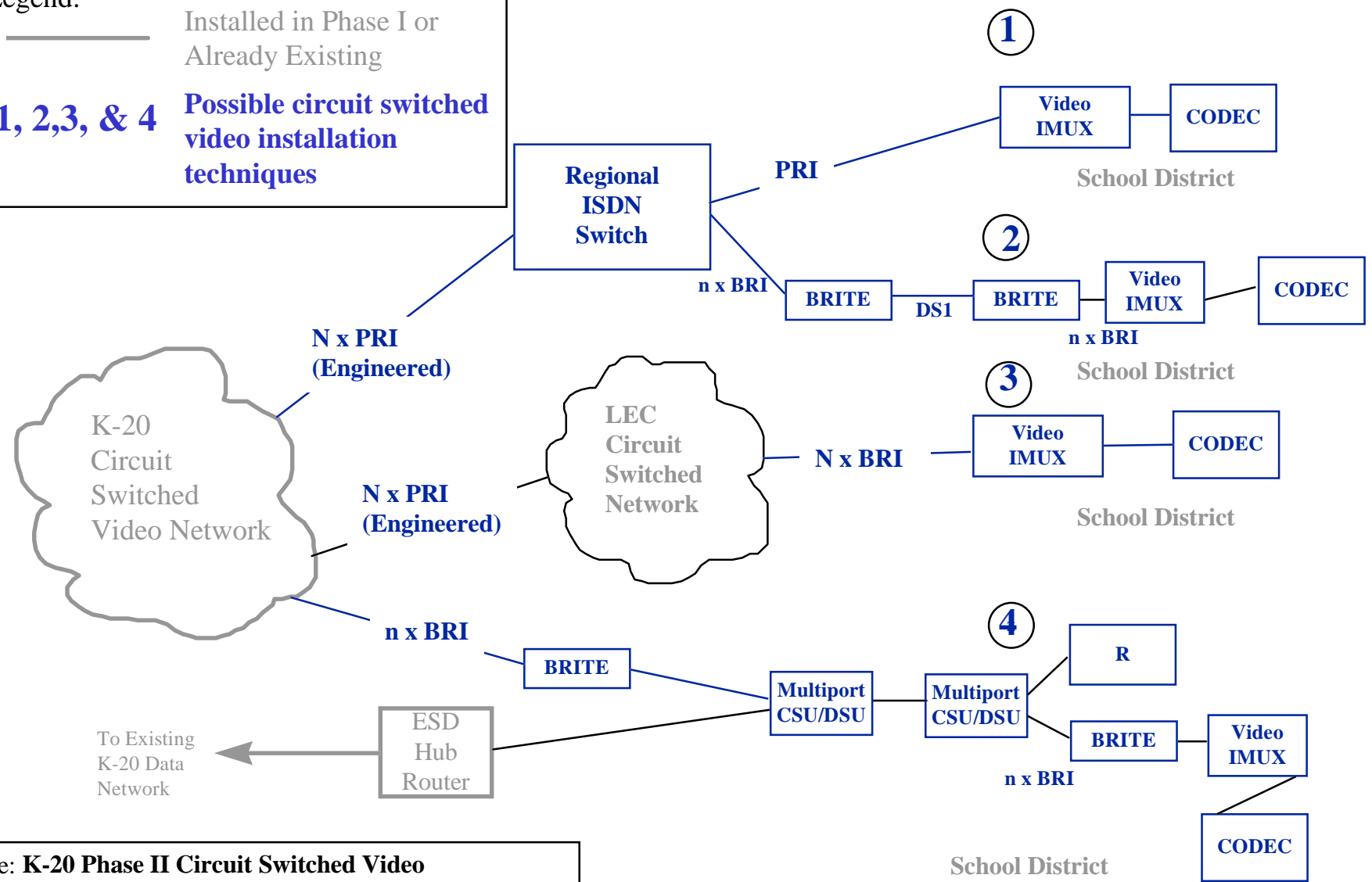
## Phase II - Circuit Switched Video

- Possible Solutions
  - Regional access to ISDN
  - BRITE technology
  - PRI circuits to K-20 switch

**Legend:**

— Installed in Phase I or Already Existing

**1, 2, 3, & 4** Possible circuit switched video installation techniques

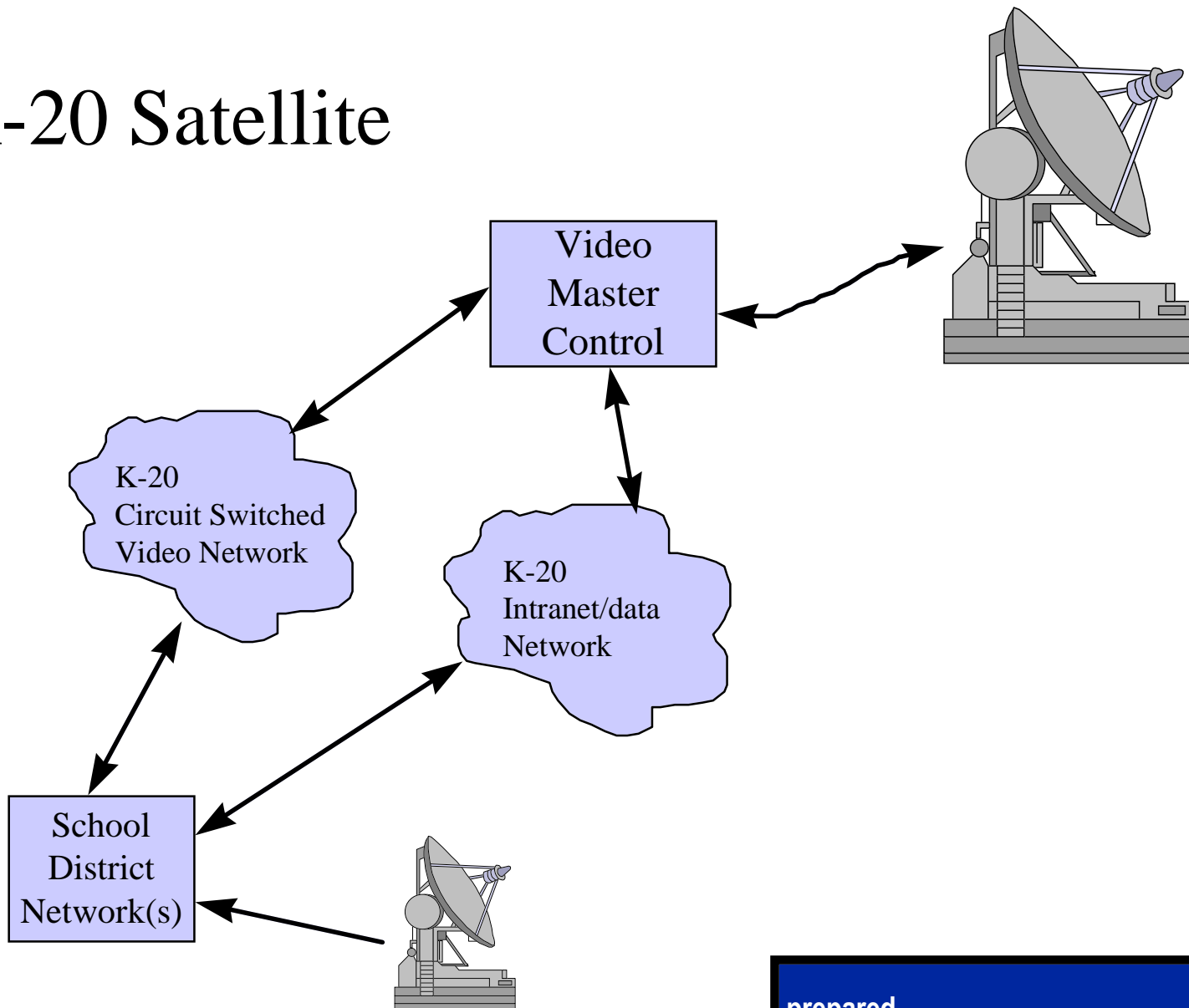


**Title: K-20 Phase II Circuit Switched Video**  
 Drawn By: Frank Leeds  
 Date: 2/22/97  
 Rev. 3.0 (5/4/97)  
 Filename: P:\K-20\Presents\K12 Overview of K20 Network

## Phase II - Satellite

- Uplink services for content distribution.
- Typically terrestrial access for K-12.

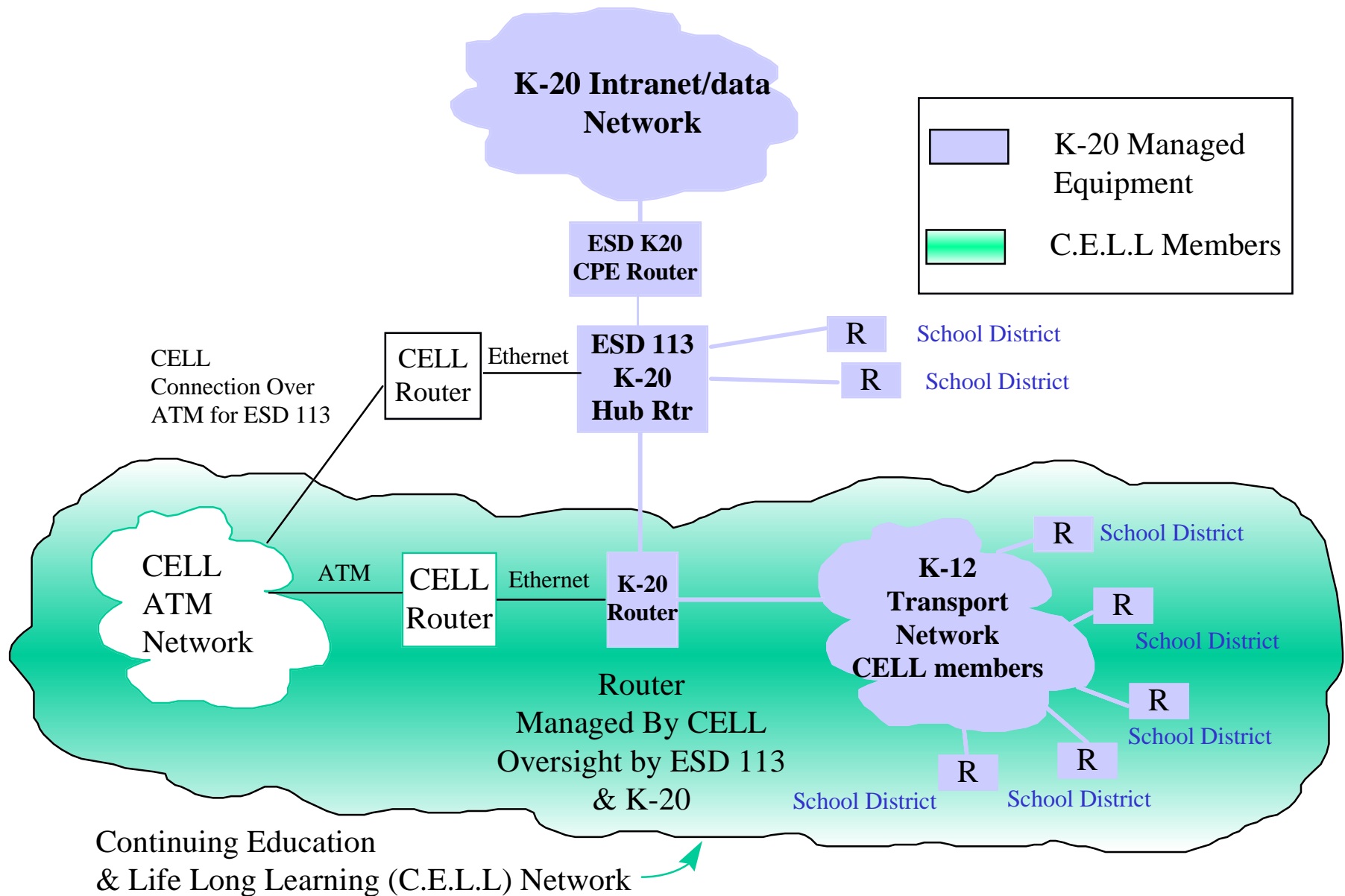
# K-20 Satellite



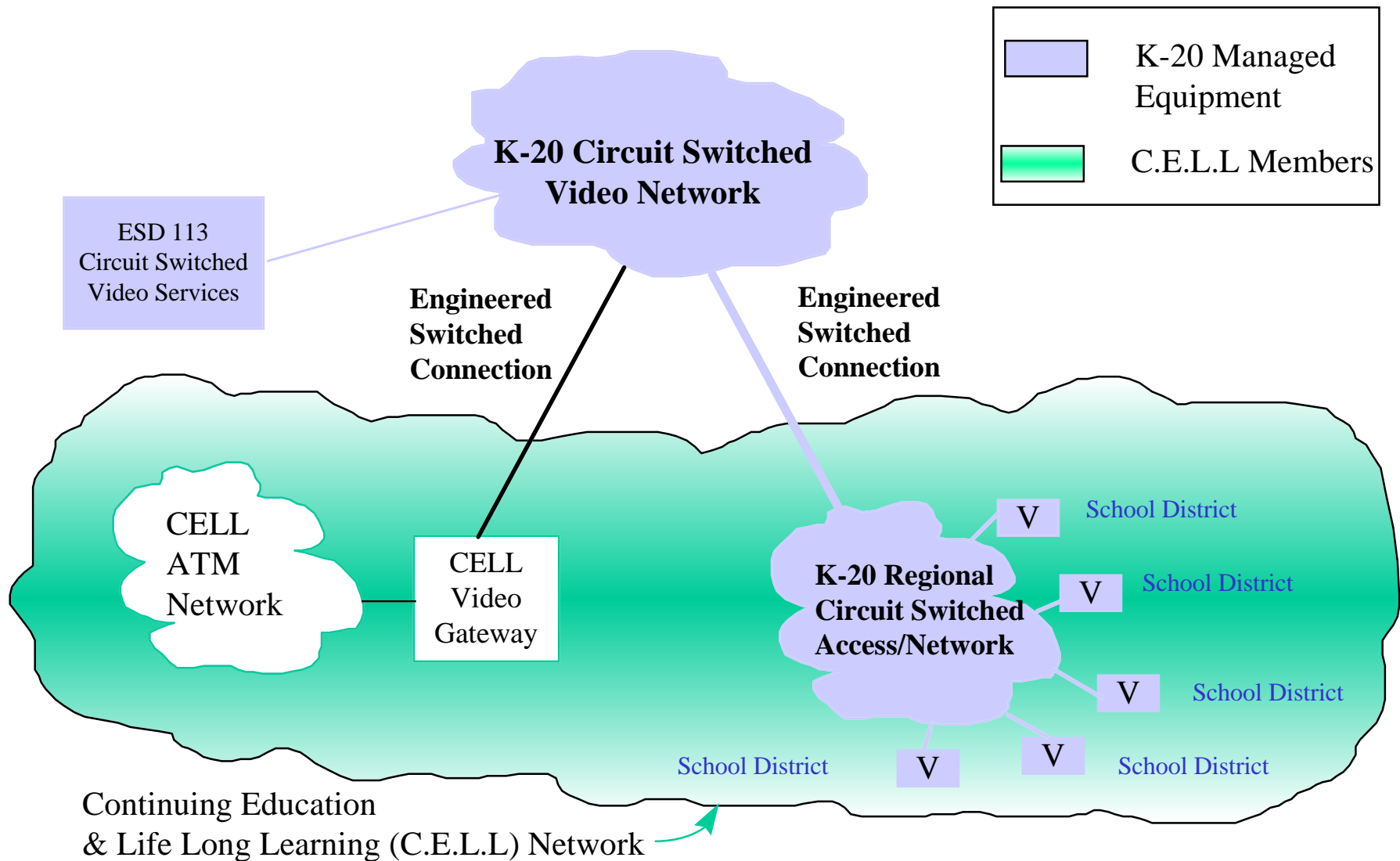
# Schedule Phase II

ID	Task Name	Start	Finish	Quarter		4th Quarter			1st Quarter			2nd Quarter			3rd Quarter			4th Quarter			1st
				Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1	Phase II Detail Design	Fri 2/28/97	Mon 12/29/97																		
2	US West Starts Project	Fri 2/28/97	Fri 2/28/97																		
3	ESD 101 Technical Meeting	Wed 3/5/97	Wed 3/5/97																		
4	All ESD Sup & Tech Staff Meeting	Fri 3/7/97	Fri 3/7/97																		
5	Statewide data gathering begins	Mon 3/10/97	Mon 3/10/97																		
6	Data collection completed	Fri 3/28/97	Fri 3/28/97																		
7	TWG defines Phase II Design Guidelines	Tue 4/22/97	Mon 5/19/97																		
8	US West begins to provide regional data	Mon 5/19/97	Mon 5/19/97																		
9	TWG defines possible aggregation scenerios	Tue 5/20/97	Mon 6/16/97																		
10	US West returns final data	Mon 6/16/97	Mon 6/16/97																		
11	TWG builds Phase I ldesign for stackholder review	Tue 6/17/97	Mon 7/28/97																		
12	Stakeholder Review	Tue 7/29/97	Mon 9/1/97																		
22	ISB Approval of Phase 2 Design	Tue 9/2/97	Mon 9/29/97																		
23	TOPC Approval of Phase II design	Tue 9/30/97	Mon 10/27/97																		
24	Phase 2 RFP Process & Contract Negotiation	Tue 10/7/97	Mon 12/29/97																		
25	Phase 2 Procurement & Install (Tentative)	Mon 12/29/97	Mon 12/29/97																		
26																					
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# K-20 & Gray's Harbor C.E.L.L Data Network



# K-20 & Gray's Harbor C.E.L.L Circuit Switched Video Network



# Data Collection Efforts

- School district contacts (funding and technology).
- Service address and phone number (NPA-NXX) of data center.
- Local telephone company contact and phone #.
- ISP contact and phone #.
- Are addresses portable?
- Current phone system - manufacturer, model, capacity.



## Data Collection (cont.)

- Number of work stations with Internet access.
- Number of additional work stations that will have Internet access in the next two years.
- Funding for video conferencing/distance learning (today, next year)?
- Environmental Issues are school district's responsibility
  - Adequate Power/grounding, Cooling, Lighting, Space.

# Benefits of K-20 Network

- Standard technology
- Scaleable
- Quality of service
- Funding

# Standard Technology

- Interoperable (DS1 technology, circuit switched interfaces to PSTN).
- Skill sets to maintain are affordable.

# Scaleable

- Capacity in backbone
  - SONET backbone for growth to cell-based technologies
  - Add & drop multiplexers (ADM) for maximum flexibility
- DIS managed
- IMUX technology

# Quality of Service

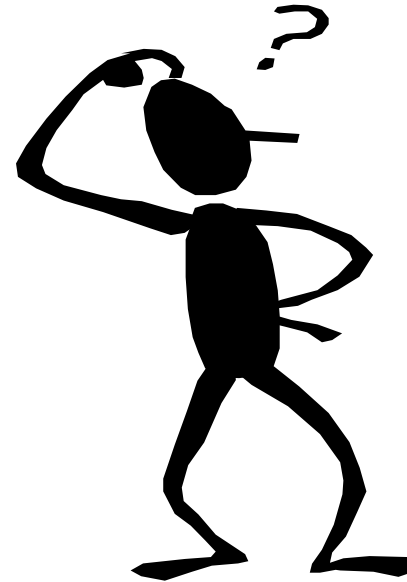
- Core centrally managed
- Regional hierarchical management
- High visibility

# Funding

- Network management allows for good capacity planning.
- Data can be sent to governance/management organization and the legislature.

# Issues and Concerns

- Equipment
- Bandwidth and transport
- Caching
- Funding
- Video
- Firewalls, DNS,  
SMTP/e-mail/addressing



## Q: What equipment will be placed at each data center?

- Router, CSU/DSU, possibly multiplexer, CODEC, video IMUX
- Component list of necessary equipment depends on the results of Phase II design and final negotiations with Phase I's apparently successful vendors.



## Q: How much room is needed for equipment?

- Equipment will mount in standard 19" equipment racks. Phase I has funding for Optima racks for each ESD.
- School districts should be prepared to add an additional rack to equipment rooms.
- ESDs should be prepared for two 19" racks

## Q: What bandwidth for each district? DS1?

- Unlimited bandwidth potential costs would be staggering; a DS3 (28 DS1s) alone to the Internet will cost approximately \$750,000/year.
- Initial Phase I backbone is not sized to support that much utilization from K-12.
- Caching servers must be used to reduce need for bandwidth.

## Q: How will bandwidth to school districts be determined?

- Will not be determined by number of FTEs or number of workstations.
- Will be determined by analysis of network traffic beginning with Phase I and continuing through Phase II and beyond.
- K-20 network management function will perform this analysis.

## Q: What if more bandwidth is needed?

- Phase I network is scaleable.
- From results of network analysis, develop capacity planning analysis and forward to governance organization.
- Funding requests for additional capacity will go to the legislature from OSPI and the HECB.

## Q: Will Frame Relay be considered in school districts?

- If it is cost effective, Frame Relay will be considered.
- Issues
  - Frame Relay lacks DS3 support.
  - Maximum 1.0 Mbps CIR (need extra frame interfaces on hub routers).
  - Increases complexity of multicast management.
- Digital aggregation in region is potentially a better long term strategy.

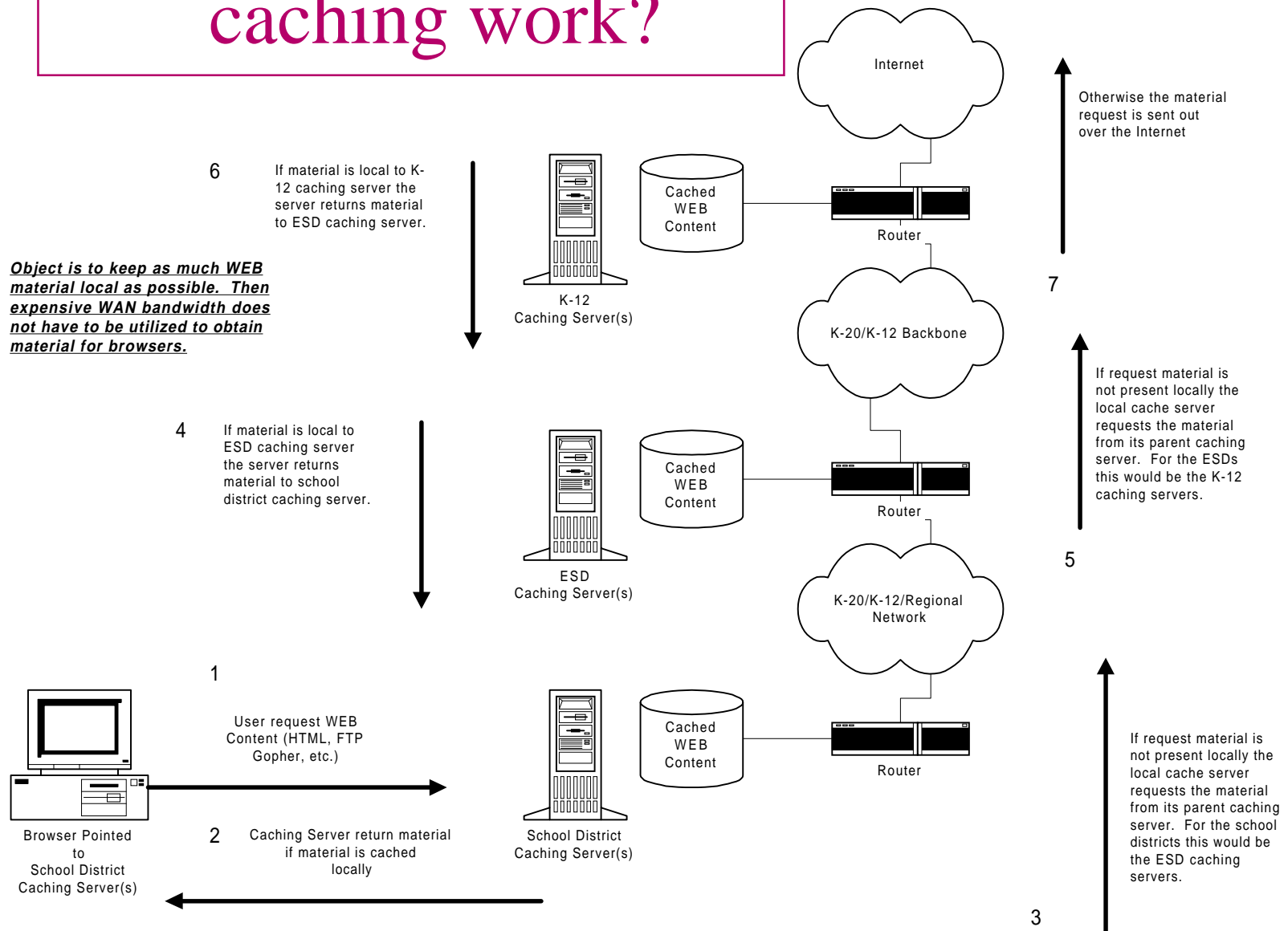
## Q: How will transport design be finalized?

- TWG will decide on most cost effective method.
- TWG has contract with US West for secondary transport. (Costs of Frame Relay and DS1s to ESD initially.)
- Will leverage US West in the regions to come back with costing information.
- TWG will leverage transport across all three sectors in Phase II to reduce costs.

## Q: What about school districts currently connected to WSIPC?

- Transition from WSIPC backbone to K-20 backbone will take time.
- Must validate new routers and circuits, then put new routes in place, “peer” with WSIPC & RDC routers (in Phase I) and validate links and routing topology.

# Q: How does caching work?





## Q: How will the caching servers be used?

- 3-layer hierarchy (“Squid” compatible).
- Equipment is not intended to support filtering and/or proxy servers. (But filtering and proxy servers can “point” to caching servers)
- “Parent” and “child” relationship.
- Internet Caching Protocol.

## Q: Can filtering be integrated with caching?

- Proxy filtering must be done on a separate box which is pointed to local caching server.
- Caching must be standardized and managed as a system.
- Caching is central to solving scaling issues for K-12.

## Q: What funding mechanisms will be in place?

- Revolving fund from user fees.
- K-20 line item for OSPI (and HECB) in their budget each year.
- Universal Access funding (federal funding).

## Q: What if a school district does not have a LAN?

- Will not receive a circuit and electronics immediately.
- Revolving account and OSPI's yearly budget for K-20 will be used to make additions.
- Legislature is committed to getting services to all districts in near future.

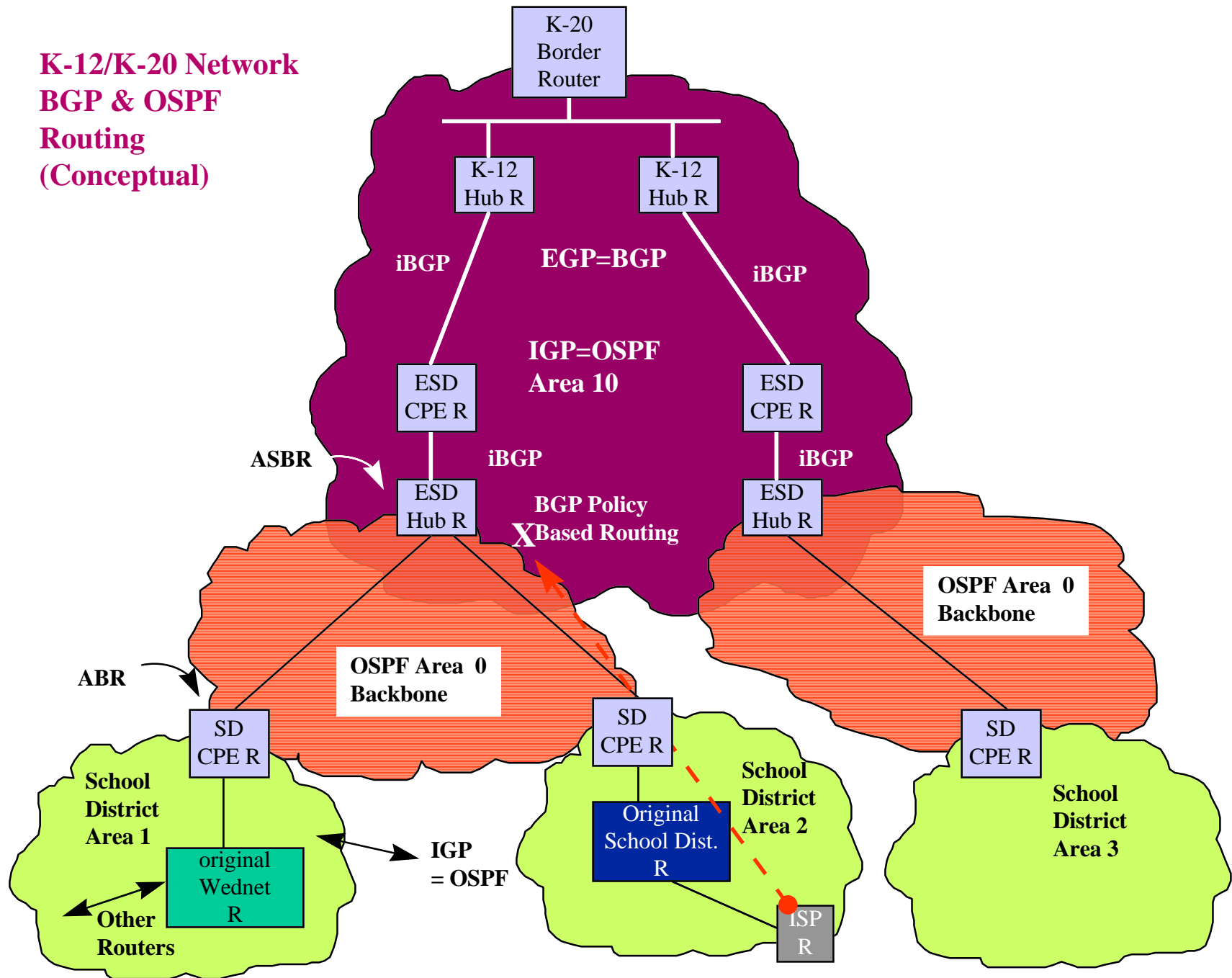
## Q: Which school districts will receive video?

- Only those school districts with money currently allocated for video will receive it.
- Regions should determine need for desktop video conferencing in teacher assessment in-services.
- Video application notes will be distributed to help regions understand circuit switched video.

## Q: How will IP addressing be handled in Phase II?

- TWG will attempt to minimize reconfigurations in K-12 sector.
- K-20 is predicated upon classless addressing and CIDR through BGP.
- If using WEdNet addresses should be okay; otherwise, check to see if your ISP agreement has a *non-portable* addressing clause.

**K-12/K-20 Network  
BGP & OSPF  
Routing  
(Conceptual)**



## Q: I'm non-Wednet & I'm Non-Portable. Now What?!

- Re-address;
  - Physically re-address each work station, or
  - DHCP (recommended)
- Or, use Network Address Translation (NAT)  
(Frowned upon by TWG)
- Build demilitarized zone and put proxy host in that zone.

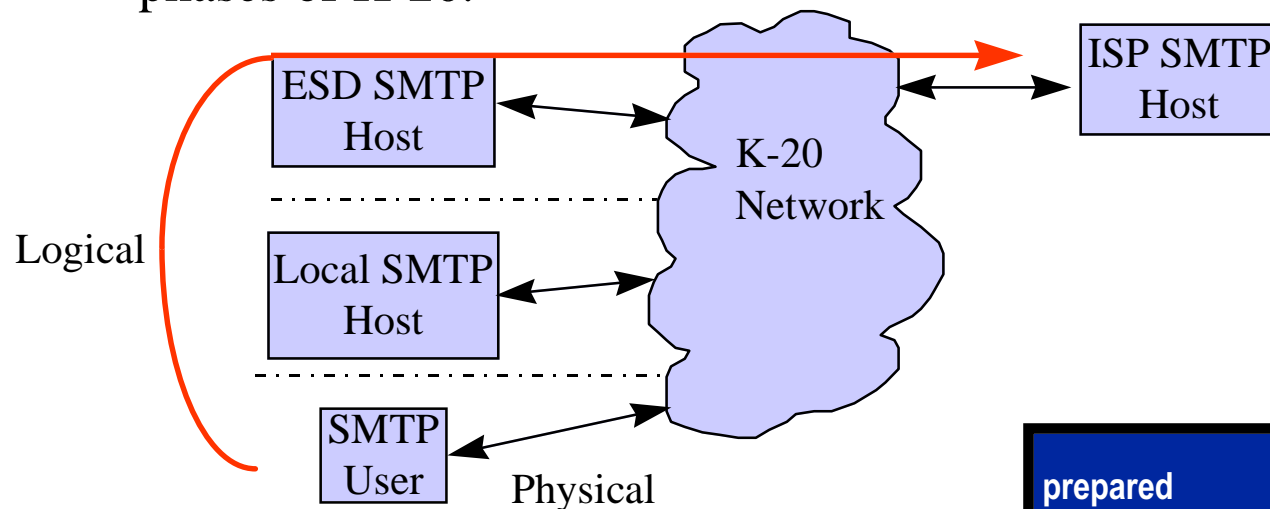


## Q: How will K-20 handle Domain Name Services (DNS)?

- Remember, nothing changes in the K-12 sector except for routers, additional bandwidth, and a central hub site.
- DNS structure remains the same through initial phases of K-20.
- May decide to hand name management of some domains to central management entity early in process.
- Later when sector management shakes out that organization will **MOST LIKELY** become responsible for naming services.

## Q: How will K-20 handle e-mail addressing?

- Remember, nothing changes in the K-12 sector except for routers, additional bandwidth, and a central hub site.
- SMTP structure basically remains the same through initial phases of K-20.



## Q: How will K-20 handle e-mail addressing (Cont.)

- If you are non-WEdNet and convert in Phase II you will have to coordinate the change of e-mail addressing with the K-12 sector management organization.
- You most likely would have to change e-mail addressing for your district.
- Later when sector management is established, that organization will **MOST LIKELY** become responsible for e-mail services.

## Q: How will K-20 handle security and traffic prioritization?

- Security is strictly domain of school districts and ESDs.
- Firewalls, proxy hosts, bastion hosts, etc. are considered part of the district's infrastructure.
- Again, traffic prioritization is a school district and ESD internal issue. Policies will have to be set and enforced to ensure data processing work is prioritized when necessary.
- OSPF can provide type of services (TOS) prioritization.

# Discussion

